COMMONWEALTH OF VIRGINIA

STATE CORPORATION COMMISSION

EX PARTE: IN THE MATTER OF RECEIVING INPUT FOR EVALUATING THE ESTABLISHMENT OF PROTOCOLS, A METHODOLOGY, AND A FORMULA TO MEASURE THE IMPACT OF ENERGY EFFICIENCY MEASURES

STAFF REPORT

CASE NO. PUE-2016-00022

June 24, 2016

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EXECUTIVE SUMMARY

The Objectives

The Establishment of Uniform Protocols

Uniform protocols are procedures for reliably and consistently estimating the energy savings and related service-territory impacts resulting from demand-side management programs and measures sponsored by investor-owned utilities and electric cooperatives. There are a number of existing protocols of varying degrees of complexity, as well as several sets of guidelines to aid in the development of uniform protocols.

The Commission could adopt a set of uniform protocols from the extant group of general protocols or it could decide to develop uniform protocols for investor-owned utilities and electric cooperatives to follow when measuring the energy savings and impacts resulting from demand-side management programs. Establishing uniform protocols or a technical resource manual ("TRM") would be an elaborate and detailed process, but with either option, there are a number of considerations with which the Commission will be faced. Among these are whether to institute a separate proceeding with stakeholder involvement, the breadth and level of specificity incorporated into the protocols, and the appropriate balance between the cost of measuring and validating energy savings and impacts and the accuracy of the measurements derived from the protocols and TRMs.

The balance between accuracy and the costs of measurement will be a particularly important consideration. Measurements or estimates derived from protocols or a TRM will involve deemed values to some degree. Deemed values are those which are based on judgment, engineering calculations, availability, etc. rather than measurement, and introduce considerable inaccuracy or uncertainty into the estimation of energy savings and impacts. The inaccuracy or uncertainty of deemed values may be mitigated by greater efforts to measure relevant inputs to energy savings calculations, but such efforts will entail greater cost.

The options available to the Commission do not have to be limited simply whether or not to adopt uniform protocols or a TRM. One option could be to adopt general guidelines which could be tailored on a case-by-case basis to suit the specific energy efficiency measure or program under consideration.

Establishment of a Methodology for Estimating Annual Kilowatt Savings

Several responding entities recommend a TRM for estimating annual kilowatt ("kW") savings; however, a TRM, given the potential for inaccuracy is not likely to be suitable for reliable measurement of kW savings.

A method of estimating annual kW savings is a related component of the evaluation, measurement, and verification ("EM&V") of energy efficiency programs and measures and could, therefore, be developed in the context of EM&V of these programs on a program- or measure-specific basis.

Establishment of a Formula to Calculate the Levelized Cost of Saved Energy

A calculated levelized cost of saved energy can be used to compare costs of an energy efficiency measure or program; however, this has limited usefulness and should not be used as a substitute for more detailed costs and benefits studies.

There are two basic formulas for calculating the levelized cost of energy, the main difference being the omission or inclusion of participant costs. If the Commission finds that a formula for the levelized cost of saved energy should be developed, the Commission will need to determine the appropriate formulation of the equation and formalize the definitions of the inputs of the formula, such as the appropriate interest rate to employ in the calculation.

The Cost/Benefit Questions

Whether Application of Costs and Benefits is Consistent Across Utilities

The application of costs and benefits is generally consistent across utilities. While Staff believes that the cost/benefit methodologies are applied consistently, inputs for the calculation of the components of the cost/benefit tests are not always calculated consistently among utilities.

While there may be perceived inconsistencies in the application of costs and benefits across utilities, this perception arises largely from changes in energy prices over time, differences in appropriate assumptions for the respective utilities, and differences related to the respective utilities' EM&V.

Whether Consistent Application of Costs and Benefits Across Utilities Is Necessary or Reasonable

The general principles of cost/benefit analysis are broadly applicable, and the California Standard Practice Manual is a consistent guideline. Therefore, in the interest of fairness and economic efficiency, the application of costs and benefits across utilities should be consistent.

To the extent that issues may arise that would appear to justify disparate treatment, Staff believes that the Commission could decide such issues on a case-by-case basis.

Whether the Application of the Cost/Benefit Tests Can Be Improved by Enhanced Evaluation and Verification Protocols for Estimating Savings Actually Realized

Accurate and comprehensive EM&V can improve the application of the cost/benefit tests. EM&V should be credible and appropriate to the measures and programs being evaluated. A given measure or program proposed by an investor-owned utility or electric cooperative should be credibly and accurately (within reason) evaluated. Credible estimates of savings will lead to more credible cost/benefit tests results.

Accuracy of measurement of estimated savings must be balanced against the cost of achieving a given level of accuracy; however, the validity of the cost/benefit test results for a given measure or program is undermined if the estimated savings of that measure or program is not credible.

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***EX PARTE:* IN THE MATTER OR RECEIVING INPUT FOR EVALUATING THE ESTABLISHMENT OF PROTOCOLS, A METHODOLOGY, AND A FORMULA TO MEASURE THE IMPACT OF ENERGY EFFICIENCY MEASURES**

CASE NO. PUE-2016-00022

Introduction

On March 30, 2016, the Virginia State Corporation Commission ("Commission") established Case No. PUE-2016-00022 pursuant to Senate Bill 395 and House Bill 1053 for the purpose of conducting an evaluation ("Evaluation") to consider the establishment of (i) uniform protocols for measuring, verifying, validating, and reporting the impacts of energy efficiency measures; (ii) a methodology for estimating annual kilowatt savings for such energy efficiency measures; and (iii) a formula to calculate the levelized cost of saved energy for such energy efficiency measures (collectively, "Objectives").[1] The Scheduling Order stated that the Commission will conduct the Evaluation and consider the Objectives as they concern energy efficiency measures implemented by both investor-owned electric utilities and investor-owned natural gas utilities.

In the Scheduling Order, the Commission ordered that the Evaluation should also encompass the methodologies by which investor-owned electric and natural gas utilities calculate the components of the cost/benefit tests in proceedings requesting approval to implement energy efficiency programs. The Commission also found that, "[i]n particular, the

[1] *Ex Parte: In the matter of receiving input for evaluating the establishment of protocols, a methodology, and a formula to measure the impact of energy efficiency measures*, Case No. PUE-2016-00022, Doc. Con. Cen. No. 160340071, Scheduling Order, (Mar. 30, 2016).

Evaluation should consider: (i) whether the application of costs and benefits is consistent across utilities; (ii) whether consistent application of costs and benefits across utilities is necessary or reasonable; and (iii) whether the application of the cost/benefit tests can be improved by enhanced evaluation and verification protocols for estimating savings actually realized" (collectively, "Cost/Benefit Questions").

Through the Scheduling Order, the Commission also sought input from the Virginia Department of Mines, Mineral, and Energy, from investor-owned electric and natural gas utilities, and other interested parties.

The Scheduling Order established May 25, 2016 as the deadline for interested persons and entities to file comments and directed Staff to file a report on or before June 24, 2016 containing Staff's evaluation of the issues under consideration in this matter. The Scheduling Order also established July 12, 2016 as the date for a public session to receive comments from interested persons and entities regarding the Objectives and the Cost/Benefit Questions under consideration in this matter.

Discussion of the Objectives

The Establishment of Uniform Protocols

Background

Uniform protocols for measuring, verifying, validating, and reporting the impacts of energy efficiency measures are standardized procedures for investor-owned utilities and electric cooperatives to follow when developing and implementing evaluation, measurement, and verification ("EM&V") plans related to demand-side management ("DSM") programs and energy efficiency programs. Uniform protocols are meant to provide predetermined procedures

for utilities to follow and to provide consistent, reliable energy saving measurements that could be employed in further evaluations.

The term "protocol" can have several meanings in the context of the EM&V of utility-sponsored energy efficiency programs. Established protocols may be general methodological guidelines to measuring energy efficiency savings, or they may extend to detailed measurement methods for specific energy efficiency programs ranging from high-efficiency heat pumps to high-efficiency room air purifiers.

A given set of uniform protocols is meant to serve as a guide to evaluators in designing and conducting EM&V and to ensure that estimates of energy savings and program impacts are transparent and reliable. It may also provide guidance to utilities in planning and offering DSM programs for approval in that it will provide a transparent basis for assessing the cost-effectiveness of proposed programs. More specifically, however, uniform protocols potentially will provide a predetermined methodology to estimate energy savings that can be used to determine "revenue reductions related to energy efficiency programs"[2] (hereinafter referred to as "lost revenues") associated with DSM programs and to evaluate ongoing DSM programs.

Existing Protocols

A number of organizations have developed existing protocols that satisfy objectives similar to those specified in the Scheduling Order. There are also existing protocols developed by various regulatory commissions, independent system operators, or other entities. The most well-known protocol developed for general application is the International Performance

[2] Pursuant to § 56-576 of the Code of Virginia ("Code"), revenue reductions related to energy efficiency programs "means reductions in the collection of total non-fuel revenues, previously authorized by the Commission to be recovered from customers by a utility, that occur due to measured and verified decreased consumption of electricity caused by energy efficiency programs approved by the Commission and implemented by the utility, less the amount by which such non-fuel reduction in total revenues have been mitigated through other program-related factors, including reduction in variable operating expenses."

Measurement and Verification Protocol[3] ("IPMVP") issued by the Efficiency Valuation Organization ("EVO").[4] The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures[5] ("UMP") developed by the U.S. Department of Energy ("DOE")[6] is also applicable on a general level. In the UMP, DOE designed a more detailed approach that is based in part upon the IPMVP. Another protocol developed for general application is Measurement & Verification (M&V) of Energy Efficiency Programs by the North American Energy Standards Board ("NAESB"). NAESB's protocols also draw upon the IPMVP protocols. Examples of protocols developed for applications in specific regions or jurisdictions include: the California Energy Efficiency Protocols ("California Protocols"),[7] Energy Efficiency Measurement & Verification,[8] developed by the PJM LLC ("PJM"), and M&V Guidelines: Measurement and Verification for Performance-Based Contracts,[9] developed through the Federal Energy Management Program. In general, these protocols build upon, or are consistent with, the IPMVP protocols.

[3] International Performance Measurement and Verification Protocol, Efficiency Valuation Organization, January 2012.

[4] According to the organization's website, the Efficiency Valuation Organization began as "a committee of volunteers who came together under a U.S. Department of Energy initiative to develop an international monitoring and verification protocol that would help determine energy savings from energy efficiency projects in a consistent and reliable manner." EVO dates its origin to 1994.

[5] The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures, National Renewable Energy Laboratory, January 2012-March 2013.

[6] According to the Energy.gov website, "[u]nder the Uniform Methods Project, DOE is developing a set of protocols for determining savings from energy efficiency measures and programs. The protocols provide a straightforward method for evaluating gross energy savings for residential, commercial, and industrial measures commonly offered in ratepayer-funded programs in the United S[t]ates [*sic*]. The measure protocols are based on a particular International Performance Measurement and Verification Protocol . . . option, but provide a more detailed approach to implementing that option. Each chapter has been written by technical experts in collaboration with their peers, reviewed by industry experts, and subject to public review and comment." The protocols are published by the National Renewable Energy Laboratory.

[7] California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals, California Public Utilities Commission, April 2006.

[8] Energy Efficiency Measurement & Verification, PJM Manual 18B, Revision 2, December 17, 2015.

[9] M&V Guidelines: Measurement and Verification for Performance-Based Contracts, Version 4.0, Federal Energy Management Program, November 2015.

In addition to protocols developed to provide guidance in EM&V and the measurement of the impacts of energy efficiency measures, a number of regulatory entities and advisory groups have issued guidelines to facilitate the development of specific protocols. These include Evaluation[,] Measurement and Verification Guidance for Demand-Side Energy Efficiency[10] (Draft) issued by the U.S. Environmental Protection Agency ("EPA"); Model Energy Efficiency Program Impact Evaluation Guide[11] developed by the National Action Plan for Energy Efficiency, and Regional EM&V Methods and Savings Assumptions Guidelines, published by the Northeast Energy Efficiency Partnerships ("NEEP").[12] (A list of protocols and guidance documents compiled by Staff may be found in Attachment No. Staff-1.)

The level of scope and complexity varies among existing published protocols. The IPMVP, which is incorporated generally into many other protocols, is primarily a framework for developing detailed EM&V methods and plans. On the other hand, the UMP, which incorporates the guidance provided in the IPMVP, is a set of detailed protocols designed for the EM&V of specific energy efficiency measures. The UMP offers options and recommendations for specific methods and savings calculations for specific energy efficiency measures that are included in the UMP.

The IPMVP provides general guidelines to measurement and other relevant considerations, such as the roles of uncertainty and weather. It is probably most well-known for its four methodological options, each based upon the characteristics of a specific energy efficiency measure, for the measurement of energy savings. (It is these four options, known as

[10] Evaluation[,] Measurement and Verification Guidance for Demand-Side Energy Efficiency , Draft for Public Input, EPA, August 3, 2015.
[11] Model Energy Efficiency Program Impact Evaluation Guide, National Action Plan for Energy Efficiency Leadership Group ("NAPEEL"), November 2007. The report reflects the views of the NAPEEL, an independent advocacy group, but DOE and EPA facilitated its development.
[12] Regional EM&V Methods and Savings Assumptions Guidelines, Northeast Energy Efficiency Partnerships, May 2010.

Options A, B, C, and D, that are generally incorporated into other protocols.) In total, the IPMVP is comprised of ten chapters and four appendices (approximately 122 pages). The UMP, on the other hand, expands upon the IPMVP options and offers additional details and specific procedures for commonly-implemented measures such as furnaces and lighting. The UMP contains thirteen chapters (approximately 373 pages). By way of contrast, the California Protocols, which also incorporate the IPMVP options, provide the primary framework for the design and conduct of energy-efficiency measure evaluations. The California Protocols are composed of eleven separate protocols and five appendices (approximately 274 pages). There are shorter, more general versions of uniform protocols, such as the NAESB and PJM protocols. Both of these protocols base their evaluation and measurement protocols upon the IPMVP and include other protocols related to statistical sampling, establishment of electricity usage baselines, etc., but provide less detail than the aforementioned protocols. The NAESB and PJM protocols consist of 18 and 40 pages, respectively.

Developing a Protocol

The appropriate content of a set of uniform protocols depends upon the aim of the issuing authority. Existing protocols mentioned above include individual sub-protocols specifying not only procedures for calculating energy efficiency savings and service territory-wide impacts related to utilities' DSM programs, but also sub-protocols establishing, among other things, procedures specifying the contents of EM&V plans; how to balance uncertainty and cost of measurement; the development of effective useful life ("EUL")[13] assumptions; sampling and uncertainty methodologies; survey design; and process evaluations.[14] An

[13] EUL is a parameter used in impact analysis of utilities' DSM programs.
[14] Process evaluations are those intended to assess the effectiveness of program designs and implementation.

evaluaton to consider the establishment of uniform protocols should, therefore, consider the desired breadth and level of specificity for those protocols. Other considerations may include flexibility in application and the extent to which the Commission might wish to cede the review of utilities' energy savings and impact estimates and, instead, rely upon a standardized methodology of estimation and measurement.

If the Commission desires to establish Virginia-specific uniform protocols, rather than adopting a general guideline, such as the IPMVP, it may be appropriate for the development process to incorporate a separate proceeding involving interested stakeholders.[15]

As noted above, uniform protocols for EM&V may be used in an effort to provide reliable and transparent estimates of energy savings and the energy impacts attributed to DSM programs, as well as the standardization of these measurements. While reliable and transparent estimates of these values may aid in assessing the cost-effectiveness of existing and proposed DSM programs, and standardize the calculation of lost revenues, uniform protocols may also aid in the efficiency of EM&V procedures by clarifying issues such as the trade-off between cost and accuracy in the measurement of energy savings and impacts. In addition, at least one interested entity responding to the Commission's Scheduling Order represents that uniform protocols, by establishing clear baselines, will also aid in the expansion of DSM programs by utilities in the Commonwealth.[16]

While these attributes may be considered positive, it is important to consider other potentially off-setting attributes of uniform protocols when evaluating their establishment. For

[15] Several respondents in this proceeding have noted the need for a stakeholder process to establish either uniform protocols or a technical reference manual ("TRM").
[16] Comments of the Environmental Respondents at 2-3.

example, the IPMVP prescribes some methods in which deemed values[17] based on historical data, manufacturers' estimates, engineering judgment, or measurement of suitable proxies are utilized in estimating energy saving impacts of DSM programs and measures. Such methods produce deemed savings[18] values as measurements of energy savings impacts of utilities' and electric cooperatives' DSM programs. Deemed savings estimates are, thus, subject to questionable or inaccurate data assumptions and judgments. If these estimates, derived from pre-approved uniform protocols, are then relied upon as the basis for energy saving impacts to be used in calculations of lost revenue or ongoing evaluation of utilities' DSM programs, the Commission may lose flexibility in its evaluation of these estimate and the underlying programs.

When evaluating the establishment of uniform protocols, the Commission should be aware of the competing or offsetting characteristics of uniform protocols, including not only the trade-offs described in the previous two paragraphs, but also the degree of specificity that the Commission would find appropriate. As described above, the level of complexity can range from that of the IPMVP, which provides a general approach to the EM&V of specific measures, to that of UMP which includes engineering formulas for each specific measure considered. An important consideration here is that in the most complex and detailed format, numerous engineering calculations would have to be developed and specified for each measure and possibly updated periodically.

[17] Deemed values are those which are not determined by measurement, but rather, are based on judgment, availability, or general determinations of suitability.

[18] Deemed savings is usually an estimate of energy savings or energy demand savings based on an estimate that has been developed from data sources or widely-accepted analytical or engineering methods.

Technical Resource Manuals

Several responding entities suggest the development of a TRM specific to Virginia.[19] TRMs are reference documents, more detailed than most uniform protocols that are designed to provide common assumptions for specific energy efficiency measures. A TRM utilizes deemed savings assumptions in conjunction with energy efficiency measure-specific information and assumptions to calculate deemed savings for a specific measure. As the name implies, TRMs are technical documents, specifying engineering equations (generally referred to as algorithms), deemed savings values, representative residential and commercial building sizes and load characteristics, etc.

A TRM is usually intended to be a "flexible" document that is periodically updated to reflect new or revised assumptions. For example, NEEP issued the sixth version of the Mid-Atlantic TRM, a TRM which has been referenced in several proceedings before the Commission. According to the NEEP website, the Mid-Atlantic TRM, Version 6[20] "documents common savings assumptions for ninety-four prescriptive[21] residential and commercial/industrial electric and gas energy measures."[22]

Establishing a TRM may entail several drawbacks. A principle concern lies in the reliance of these documents on deemed values, even though these values may be periodically updated. The Commission previously has determined that "purely secondary sources of formulae and data gathered from outside of Virginia [is] less rigorous at measuring and

[19] A partial list of interested entities includes, Virginia Department of Mines, Minerals and Energy; Appalachian Power Company ("APCo"), Virginia Energy Efficiency Council, and the American Council for an Energy Efficient Economy ("ACEEE").
[20] http://www.neep.org/mid-atlantic-technical-reference-manual-v6.
[21] Prescriptive energy efficiency measures are those measures in which a specific technology offered with a pre-established incentive structure, such as a high-efficiency heat pump or duct sealing. Prescriptive measures are in contrast to custom measures whereby a participant proposes energy efficiency measures that the participant wishes to undertake.
[22] http://www.neep.org/mid-atlantic-technical-reference-manual-v6.

verifying decreased consumption of electricity . . . than Virginia-specific data would be," and that using such data to estimate electricity savings did not meet the statutory standard of measured and verified.[23] The Commission has reiterated its concerns with non-Virginia-specific data in other cases.[24] Without Virginia-specific data, a TRM for Virginia would have to rely, at least initially, on measured or deemed assumptions from other jurisdictions. For example, the 94 prescriptive measures detailed in the Mid-Atlantic TRM incorporate assumptions based on data or surveys from, *inter alia,* the New England states, Illinois, New Jersey, California, and Ontario, Canada. The vintage of the data supporting these assumptions dates from the early 2000s to as far in the past as 1986 in one case found by Staff.

The potential scope of a TRM may present an additional difficulty. Engineering algorithms must be determined for each measure and, more significantly, hundreds of requisite underlying assumptions must be determined. Examples of such data include full load heating and full load cooling hours which would have to be developed to determine the savings resulting from a high-efficiency heat pump, and incoming water temperature and number of persons per household, among other inputs, which would have to be developed to determine the savings resulting from a high-efficiency gas water heater, etc.

The general nature of TRMs allows them to be useful, but not necessarily authoritative, in a context of the initial assessment of proposed DSM measures; however, accuracy may be

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[23] *Application of Virginia Electric and Power Company, For approval to continue two rate adjustment clauses, Riders C1 and C2, as required by the Order Approving Demand-Side Management Programs of the State Corporation Commission in Case No. PUE-2009-00081*, Case No. PUE-2010-00084, 2011 S.C.C. Ann. Rept. 342, Order Approving Rate Adjustment Clauses, (Mar. 27, 2011).

[24] *See, e.g., Application of Columbia Gas of Virginia, Inc., For authorization to amend and extend its conservation and ratemaking efficiency plan pursuant to Virginia Code § 56-602*, Case No. PUE-2015-00072, 2015 S.C.C. Ann. Rept. 354, Final Order (Oct. 29, 2015); *Application of Washington Gas Light Company, for authority to amend its natural gas conservation and ratemaking efficiency plan,* Case No. PUE-2010-00079, 2010 S.C.C. Ann. Rept. 573, Order on Application to Amend Conservation and Ratemaking Efficiency Plan (Nov. 18, 2010).

questionable when calculating energy savings and impacts for lost revenue calculations or for an assessment of cost-effectiveness of ongoing programs.

For example, the 2016 Mid-Atlantic TRM includes an algorithm to calculate the energy savings achieved through the use of a low-flow showerhead. This algorithm requires, *inter alia,* a measurement of gallons per day per person for showering. In lieu of an actual measurement, the Mid-Atlantic TRM, citing a U.S. Environmental Protection Agency ("EPA") document,[25] provides an assumed value of 11.6 gallons per day per person for showering. If one accesses the EPA document, one finds that the source of the assumed value of 11.6 gallons per day is a 1998 study sponsored by the American Water Works Association ("AWWA") entitled Residential End Uses of Water. If one accesses the AWWA study, one finds that the study was conducted in twelve localities, ten of which were in the far western United States, one in Florida, and one in Ontario, Canada.[26] Moreover, the authors state in the Executive Summary of the AWWA study that, "Creating national water use 'averages' was not an objective of this study. The pooled results are presented for summary and comparative purposes alone."[27]

Another example, although not directly taken from a TRM, illustrating the potential inaccuracy of deemed savings values may be drawn from Case No. PUE-2015-00089.[28] This example reveals the difference that may arise from deemed and measured kilowatt ("kW")

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[25] http://www.epa.gov/watersense/docs/home_suppstat508.pdf.

[26] The specific localities in the AWWA study were: Boulder and Denver, Colorado; Eugene, Oregon; Seattle, Washington; San Diego and Lompoc, California; Phoenix and Tempe/Scottsdale, Arizona; Tampa, Florida; Waterloo, Ontario, Canada; and the Walnut Valley Water District and the Las Virgenes Municipal Water District in California. Residential End Uses of Water, AWWA Research Foundation, 1999 at xxiii.

[27] *Id.* at xxii.

[28] *Petition of Virginia Electric and Power Company, For approval to implement new demand-side management programs, for approval to continue a demand-side management program, and for approval of two updated rate adjustment clauses pursuant to § 56-585.1 A 5 of the Code of Virginia*, PUE-2015-00089, Doc. Cen. Con. No. 160420196, Final Order (April 19, 2016).

savings and the regulatory inertia that can be present in updating deemed values. At issue was a discrepancy between the assumed kW savings of participants in Dominion Virginia Power's ("Dominion") Air Conditioner Cycling Program and the actual kW savings measured by Dominion's EM&V for that program. For purposes of the cost/benefit analysis for this program, Dominion assumed that the annual per participant kW savings related to the program was 1.0 kW, the same assumed annual per participant kW savings utilized in the Dominion's initial petition seeking approval for the program.[29] Dominion conceded that .69 kW was a more appropriate assumption based on the current EM&V results, but requested additional time to thoroughly analyze the kW savings of this program in order to "characterize the impact of exogenous market changes on the [p]rogram, assess the [p]rogram's implementation approach, and mitigate any potential biases in the modeling approach."[30] Staff does not make this illustration as a criticism of Dominion's EM&V, but rather to point out that more than six years after the Air Conditioning Cycling Program was first implemented,[31] it is questionable that an appropriate updated value of annual per participant savings is available.

There is also some question as to whether a TRM would contain sufficient flexibility to adequately represent, within a sufficient degree of accuracy, the Virginia utilities, as well as the electric cooperatives give the diversity of their respective service territories. One entity, the Association of Electric Cooperatives, commented, "The Cooperatives may need to depart from a uniform TRM for various reasons—demographic, geographic, topographic, etc." One of the more appealing properties of TRMs is their general application. If certain utilities or electric

[29] Exh. 15, Pre-filed Testimony of Mark K. Carsley, PUE-2015-00089 at 19.
[30] Exh. 17, Rebuttal Testimony of Timothy J. Pettit, PUE-2015-00089 at 4, 6-7.
[31] *Application of Virginia Electric and Power Company, For approval to implement new demand-side management programs and for approval of two rate adjustment clauses pursuant to § 56-585.1 A 5 of the Code of Virginia*, PUE-2009-00081. S.C.C. Ann. Rept. 362, Order Approving Demand-Side Management Programs (Mar. 24, 2010) ("2010 Order").

cooperatives would seek to depart from the use of any TRM that is developed, then the development of a TRM may be a wasted exercise.

In summary, a TRM may be suitable as a generalized, streamlined process for determining potential savings from energy efficiency programs; however, they are not suitable for the calculation of actual savings unless the Commission wishes to apply a general, streamlined approach with the recognition that such an approach is more likely to produce less accurate results.

Commission Options

Given the considerations discussed above, the Commission could pursue several options with respect to the establishment of a uniform protocol:

- Establish a proceeding to develop Virginia-specific set of uniform protocols;
- Establish a proceeding to adopt an existing protocol or an appropriate combination of existing protocols;
- Endorse a general guideline or set of general protocols that would allow the establishment of individual, company-specific guidelines on a case-by-case basis. Under this approach, the Commission would follow generally accepted protocols, but tailor specific aspects of the protocols to the case at hand.
- decline to adopt or endorse a uniform protocol.

Staff believes careful consideration must be given to any adoption, creation, or alteration of a set of uniform protocols by the Commonwealth. As has been previously mentioned, an inherent compromise must be struck between accuracy and reliability of gathered or estimated data and the cost and effort expended to gather or estimate the necessary data. The more rigorous the requirements for accuracy in the protocols, the greater the cost and

expended effort to generate such data; easier-to-implement protocols may result in less accurate or less reliable estimates of savings.

Establishment of a Methodology for Estimating Annual Kilowatt Savings

The purpose of a methodology for estimating annual kW savings is a significant consideration in an evaluation of its establishment. Several entities support the use or development of a TRM or other deemed savings methodology for estimating annual kW savings[32] As discussed above, while a TRM or deemed savings approach may be sufficient for a cost/benefit assessment of a new, proposed DSM measure or program, such approaches are likely to be insufficiently accurate for purposes of cost/benefit assessments of ongoing programs. A deemed savings or TRM methodology is also not likely to be suitable for comparison of kW savings of DSM programs and measures with generation options or for the purposes of incentivizing utilities and electric cooperatives to establish DSM measures and programs. This lack of suitability is directly related to the potential inaccuracy of TRMs that is discussed above.

A method for estimating annual kW savings is a related component of EM&V and could be developed in that context, whereby the appropriate parameters to determine utility-specific data could be specified and subsequently measured.

Establishment of a Formula to Calculate the Levelized Cost of Saved Energy

A levelized cost of saved energy ("LCSE") is a metric that can be used to compare the costs of particular DSM programs and measures to one another by type or over time. LCSE can also be used to compare costs among program administrators. As noted by several

[32] Comments of Virginia Electric and Power Company at 20; Comments of APCo at 3.

respondents, this calculation is of somewhat-limited use as it is not a direct evaluation of the costs and benefits of any proposed program.

The basic formulas for the LCSE are relatively straightforward, but important practical distinctions can be made depending on the costs that are included. The most basic distinction is whether only utility program costs are included or both utility program costs and incremental participant costs, *i.e.*, total costs, are included. When incremental participant costs are excluded, the LCSE is a measure of the program administrator's (or utility's) cost of saved energy.

This distinction is important because without the inclusion of participant costs, the LCSE calculation does not include all of the costs of saved energy. Thus, when one attempts, for example, to draw comparisons between the LCSE and the levelized cost of electricity generation, if one does not include participant costs, the comparison is between one alternative (electricity generation) that includes all costs borne by ratepayers and the second alternative (saved energy) that does not include all out-of-pocket expenses that participants must pay. Further, saved energy is not a dispatchable commodity, and the lack of dispatchability introduces another significant difference between the value of saved energy and the value of generated electricity at any particular point in time.

Equations and definitions for the calculation of LCSE can be found in Attachment No. Staff-2.

Should the Commission select either equation for implementation, Staff encourages due consideration be given to which interest rate to use as an input. Both equations presented utilize a real interest rate for calculation of the capital recovery factor. Staff believes that a nominal interest rate is more appropriate. If the LCSE is to be a proxy for a true, levelized cost

of a utility, a nominal interest rate should be included in the capital recovery formula because a nominal interest rate approximates the actual interest rate that a utility faces in financial markets.[33] (If a comparison between the LCSE and the levelized cost of electricity generation is drawn, the use of a real interest rate in the LCSE equation will introduce a downward bias in the cost of saved energy with respect to the levelized cost of electricity generation which usually includes a nominal interest rate.) Staff also believes that the nominal interest (discount) rate should be specific to a given utility's weighted-average cost of capital because the LCSE is appropriately the cost of saved energy to a given utility.

In evaluating the establishment of a formula to calculate the LCSE of DSM programs and measures, the Commission must decide which equation, either Equation (1) or Equation (2), appropriately represents the cost of saved energy. The Commission must also decide whether a real discount (interest) rate or a nominal discount (interest) rate is appropriate to determine the LCSE. Staff believes that Equation (2), which includes utility program costs and incremental participant costs, is the appropriate equation, and that a nominal discount (interest) rate should be incorporated into the capital recovery factor. The Commission may also wish to formalize the definitions of the components in any chosen LCSE equation in order to ensure fairness and standardization in the calculations of the LCSE among utilities.

In evaluating the establishment of a methodology to calculate the LCSE, the Commission may wish to consider the use to which the measure of the LCSE would be put. As discussed above, the LCSE is an inappropriate comparison to the levelized cost of electricity generation and provides no useful information with respect to the cost-effectiveness of DSM measures and programs given that LCSE calculations do not incorporate the value of electric

[33] The use of a nominal interest rate will yield a higher LCSE than a real interest rate which does not account for expected inflation.

generating capacity or the value of other components that are included in the cost/benefit tests required by § 56-576 of the Code.

If the Commission decides to establish a methodology to calculate the LCSE, Staff recommends that measurement of the components of the LCSE equation be made through a utility's EM&V rather than through a deemed savings approach or a TRM. As discussed above, a deemed savings approach to the calculation of the LCSE would be an approximation at best and could prove to be inaccurate.

Discussion of the Cost/Benefit Questions

Background

In responding to the Scheduling Order, several entities commented on how the Commission evaluates the cost/benefit tests specified in §§ 56-576 and 56-600 of the Code.[34] In particular, these comments, some of which are misguided and others of which are incorrect, are directed at the Commission's perceived reliance solely on the Ratepayer Impact Measure ("RIM") Test in approving or rejecting energy efficiency programs proposed in the Commonwealth.

The joint comments of Columbia Gas of Virginia, Inc., Virginia Natural Gas, Inc. and Washington Gas Light Company ("Gas Utilities") proffered as an obstacle to the approval of "cost-effective conservation and energy efficiency programs:"

> The principle that an energy efficiency measure is not cost-effective if the measure reflects a negative net present value ("NPV") under the [RIM] Test, unless that negative RIM NPV is offset by an equivalent or greater positive NPV for the measure under the Total Resource Cost ("TRC") Test,

[34] *E.g.*, Comments of the Virginia Energy Efficiency Council and Comments of Columbia Gas of Virginia, Inc., Virginia Natural Gas, Inc. and Washington Gas Light Company.

> inappropriately eliminates measures based on the results of a single cost-effectiveness test, where the measure passes the remaining three tests.[35]

Notwithstanding the mathematical fact that considering the *level* of the NPV of one cost/benefit test relative to the *level* of the NPV of another test takes into account at least two tests, the principle stated in the Gas Utilities' comments has never been a principle endorsed by the Commission.

Another example which is often cited is the Commission's 2010 Order, in which the Commission rejected several residential energy efficiency programs proposed by Dominion. Contrary to statements that the Commission rejected these programs simply because they did not pass the "RIM" Test, the Commission's 2010 Order stated:

> In this regard, we find that the programs not approved, under the current circumstances, have not been proven to be in the public interest as required by § 56-585.1 A 5 of the Code. For example, Consumer Counsel and Staff note the low RIM scores of these programs, which also do not have significant offsetting and reliable TRC scores. . . . Moreover, the Company's proffered test results tend to be inflated in certain instances. As explained by Consumer Counsel, certain deficiencies in the Company's cost/benefit analyses 'tend to overstate projected benefits of DSM programs, deemphasize potential downside risk associated with such programs, or introduce uncertainty regarding the costs and benefits for proposed programs.[36]

The 2010 Order clearly shows that the Commission did not simply base its decision on low RIM Test scores.

With respect to the RIM Test, many specious criticisms have been offered as to the nature of the test. For example, one criticism is that, "The RIM [T]est . . . does not provide

[35] Comments of Columbia Gas of Virginia, Inc., Virginia Natural Gas, Inc. and Washington Gas Light Company ("Gas Utilities Comments") at 3.
[36] *Id.*, at 365.

regulators and other stakeholders with information necessary to assess rate impact or distributional equity issues that go along with them."[37] This assertion is incorrect. According to the California Standard Practice Manual ("CSPM") the seminal source of the cost/benefit tests, the RIM Test "indicates the direction and magnitude of the expected change in customer bills or rate levels."[38] The RIM Test also specifically shows the distributional effect of energy efficiency programs on non-participants. According to the CSPM, "The [RIM] Test has previously been described under what was called the "Non-Participant Test."[39]

Another criticism of the RIM Test is that the test does not take into account the potential for energy efficiency measures to defer new capital investment in capacity or distribution. This criticism is incorrect. "The benefits calculated in the RIM test are the savings from avoided supply costs. These avoided costs include the reduction in transmission, distribution, generation, and capacity costs for periods when load has been reduced . . . ."[40]

Finally, it has been claimed that the RIM Test "assesses the benefit/costs for one group (non-participants) over the short-term" and "ignores impact on bills, savings to participants, and avoided costs of new generation."[41] The discussion in the previous two paragraphs shows that this claim as to the impact on bills and the avoided costs of generation is incorrect. As to the claim that the RIM Test ignores savings to participants, that is true, because participant savings are explicitly measured in a separate test, the Participant Test, and subsumed in another test, the TRC Test.

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[37] "Regulatory Policies to Support Energy Efficiency in Virginia: A Discussion of Issues for the 2014 Virginia Energy Efficiency Workshop," Prepared for the Virginia Energy Efficiency Council, October 1, 2014 at 14.
[38] California Standard Practice Manual, July 2002 at 13.
[39] *Id.* at fn 5.
[40] 2010 Order at 365 (internal footnotes omitted).
[41] Opower Presentaton to the Energy Advisory Committee of the Joint Committee on Science and Technology, 2011.

Concentrating criticism on the RIM Test ignores that the RIM Test is but one of four *interrelated* cost/benefit tests that are not intended to be used independently. The four tests are mathematically structured to be used in conjunction with one another. As noted in the CSPM:

> The tests set forth in this manual are not intended to be used individually or in isolation. The results of tests that measure efficiency, such as the Total Resource Cost Test, the Societal Test, and the Program Administrator Cost Test, must be compared not only to each other[,] but also to the Ratepayer Impact Measure Test. This multi-perspective approach will require program administrators and state agencies to consider tradeoffs between the various tests.[42]

Criticism of the RIM Test has prompted many comments, both in the instant case and outside of it, regarding overly-rigorous analysis of proposed DSM measures and programs, resulting, in part due to failure to pass one or more of the cost/benefit tests, in the rejection of worthwhile proposals. This, it is argued, has resulted in higher electric bills for customers in the Commonwealth relative to national averages, the inference being that these rejected DSM programs and measures would have reduced average customer bills. Staff is not aware of any empirical analysis that demonstrates that lower average electric bills for a given State is solely attributable to the efficacy of that State's utility sponsored energy efficiency initiatives or vice versa. Average electrical bills are impacted by numerous drivers, the majority of which are not impacted by a State's energy efficiency policies.

Staff has performed a study of Virginia residential electricity consumption which found that, overwhelmingly, a higher percentage of Virginian residential energy consumers use electricity for end uses than the national average.[43] In particular, Virginians use electricity for heating and cooling to a much greater extent than the national average. Staff's research also

[42] California Standard Practice Manual at 6.
[43] Based on information available in *Residential Energy Consumption Survey, 2009*, United States Energy Information Administration, August, 2013.

found that, despite this, Virginia residential customers consume approximately 4 percent less total energy[44] than the national average.[45]

Staff's research also found that, compared to other States ranked highly by the ACEEE for their efforts in energy efficiency, Virginia consumes less total energy than many highly-ranked States.[46] It could be argued that the energy efficiency measures in these highly-ranked States are preventing them from consuming even higher above the national average of total energy consumption; however, it could also be argued that despite attempts by these States to increase energy efficiency, the return on such investments in energy efficiency are not resulting in expected values.

Responses to the Cost/Benefit Questions

(i) Whether the Application of Costs and Benefits is Consistent Across Utilities;

The application of costs and benefits is generally consistent across utilities in that the cost/benefit tests required by §§ 56-576 and 56-600 of the Code are defined and discussed in the CSPM.[47] Staff generally adheres to the CSPM when reviewing the cost/benefit tests results of proposed in programs and measures and attempts to apply the tests uniformly across utilities.

Although Staff interprets the cost/benefit tests consistently, the inputs of each test are not always calculated consistently among utilities. For example, in determining a price forecast

[44] "Total energy" is defined as all fuels used in residential customers' homes, to include electricity, natural gas, propane, wood, fuel oil, and kerosene.

[45] "Virginia households consume an average of 86 million [British thermal units] per year, about 4% less than the U.S. average." *Residential Energy Consumption Survey, 2009 State Fact Sheet, Virginia*, United States Energy Information Administration, August, 2013.

[46] Massachusetts residences consume approximately 109 MMBtu per year (approximately 22 percent more than national average) while being ranked second for energy efficiency measures by the ACEEE in 2009. New York residences, ranked fifth for energy efficiency measures by the ACEEE in 2009, consumed 103 MMBtu (approximately 15 percent more than national average). *Residential Energy Consumption Survey, 2009, State Fact Sheet, Massachusetts*, and *Residential Energy Consumption Survey, 2009, State Fact Sheet, New York*, United States Energy Information Administration, August, 2013.

for electrical energy for purposes of the cost/benefit tests, Dominion generally relies upon a private consulting firm. In contrast, APCo relied upon an in-house price forecast to support its application for approval of certain DSM programs filed in Case No. PUE-2014-00039.[48] Similarly, when calculating avoided supply cost, a key component in several of the cost/benefit tests, Dominion utilizes the Strategist planning model. In Case No. PUE-2014-00039, APCo utilized an in-house model to determine avoided supply costs. While a uniform method for calculating all components may be desirable, such a uniform calculation may not be practicable.

The Gas Utilities commented in this proceeding that, "The cost-effectiveness tests and the associated standard of review of the Gas Utilities' respective CARE measures and programs do not appear to be consistently applied across natural gas utilities."[49] The Gas Utilities note that some measures have been approved for some natural gas companies, but rejected for other companies, and that some measures have been approved in a company's CARE Plan application at one point in time and subsequently disapproved in a subsequent CARE Plan application.

There are three general reasons for these apparent discrepancies: 1) natural gas prices, and the associated forecasts, have fallen significantly over the past several years; 2) assumptions utilized in a respective company's cost/benefit analysis have not been credible; and

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[47] The four cost/benefit tests required by §§ 56-576 and 56-600 of the Code are the Participant Test, the Utility/Program Administrator Cost Test, the RIM Test, and the TRC Test.

[48] *Petition of Appalachian Power Company, For approval to implement a portfolio of energy efficiency programs and for approval of a rate adjustment clause pursuant to § 56-585.1 A 5 c of the Code of Virginia*, Case No. PUE-2014-00039, 2015 S.C.C. Ann. Rept. 215, Final Order (June 24, 2015).

[49] Gas Utilities Comments at 6-8.

3) a respective company's EM&V has indicated that actual measured savings may differ from those assumed in another Company's cost/benefit analyses.[50]

The Gas Utilities point out that in 2013, the Commission rejected a proposed Storage Water Heater measure by Washington Gas Light Company ("WGL")[51] while approving a proposed Storage Water Heater measure by Virginia Natural Gas Inc. ("VNG").[52] The predominant reason related to the approval of VNG's Storage Water Heater Measure was a higher level of assumed annual dekatherm ("dth") savings per high-efficiency water heater (which was validated by VNG's EM&V) relative to the assumed annual dth savings per high-efficiency water heater for WGL's high-efficiency water heater measure.[53] This resulted in higher cost/benefit test results initially for VNG's program. WGL's cost/benefit model assumptions also were not as well-substantiated, and the associated lower cost/benefit tests indicated the WGL's program was not as cost-effective.

The Gas Utilities also commented that the Commission approved a High-efficiency Tankless Water Heater measure proposed by Columbia Gas of Virginia, Inc. ("CGV") in April 2012,[54] but rejected a similar measure proposed by WGL in December 2012.[55] Irrespective of

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[50] Moreover, there a several other reasons why one would not expect a given measure in one company's service territory may be cost-effective, but might not be cost-effective in other company's service territory. For example, the respective companies may have differing levels of avoided costs; the program costs that a given natural gas company builds into its CARE Plan may differ; weighted average cost of capital assumptions (used to discount future costs and benefits) may differ; and given the wide geographic range of the natural gas companies in the Commonwealth, measures that are cost-effective in one natural gas companies service territory may not be cost-effective in another companies service territory.

[51] *Application of Washington Gas Light Company, For authority to amend its natural gas conservation and ratemaking efficiency plan*, Case No. PUE-2012-00138, 2013 S.C.C. Ann. Rept. 335, Order Approving Amended Natural Gas Conservation and Ratemaking Efficiency Plan (Apr. 2, 2013) ("2012 WGL Case").

[52] *Application of Virginia Natural Gas, Inc., For approval of a natural gas conservation and ratemaking efficiency plan and rider*, Case No. PUE-2012-00118, 2013 S.C.C. Ann. Rept. 298, Order Approving Natural Gas Conservation and Ratemaking Efficiency Plan (May 30, 2013).

[53] The same outside consultant performed the cost/benefit analysis for WGL and VNG, respectively, in Case No. PUE-2012-00138 and Case No. PUE-2012-00118.

[54] *Application of Columbia Gas of Virginia, Inc., For approval to implement a natural gas conservation and ratemaking efficiency plan*, Case No. PUE-2012-00013, 2013 S.C.C. Ann. Rept. 395, Final Order (Aug. 6, 2012) ("2012 CGV Case").

[55] 2012 WGL Case.

any changes in the price of natural gas over the relevant period, CGV entered into a settlement with Staff in the 2012 CGV Case, whereas the Commission decided the 2012 WGL Case subsequent to Staff's settlement with CGV. The tradeoffs involved in the negotiation of the settlement resulted in the inclusion of the Tankless Water Heater in CGV's CARE Plan, whereas subsequent to Staff's settlement with CGV, the Commission disapproved the Tankless Water Heater measure proposed by WGL.

The Gas Utilities also question the Commission's seemingly incongruous approval of Attic and Floor Insulation measures proposed by CGV in 2009,[56] 2012,[57] 2014,[58] and 2016,[59] while rejecting WGL's proposed residential Attic and Floor Insulation measures in 2015.[60] As noted in the Staff Report in the 2015 WGL Case, WGL assumed annual combined savings for these two measures of 76 dth when WGL's most recent estimate of residential weather-normalized usage was78.1 dth.[61] In other words, WGL's cost/benefit analysis of the proposed residential Attic and Floor Insulation measures assumed that a residential customer undertaking both measures would reduce, on average, approximately 97 percent of that customer's annual gas usage. Staff challenged this assumption and recommended that the Commission not approve the Attic and Floor Insulation measures.

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[56] *Application of Columbia Gas of Virginia, Inc., For approval to implement a natural gas conservation and ratemaking efficiency plan including a decoupling mechanism*, Case No. PUE-2009-00051, 2009 S.C.C. Ann. Rept. 484, Final Order (Dec. 4, 2009).

[57] 2012 CGV Case.

[58] *Application of Columbia Gas of Virginia, Inc., For authority to amend its natural gas conservation and ratemaking efficiency plan pursuant to Chapter 25 of Title 56 of the Code of Virginia*, Case No. PUE-2013-00114, 2014 S.C.C. Ann. Rept. 326, Final Order (Apr. 10, 2014).

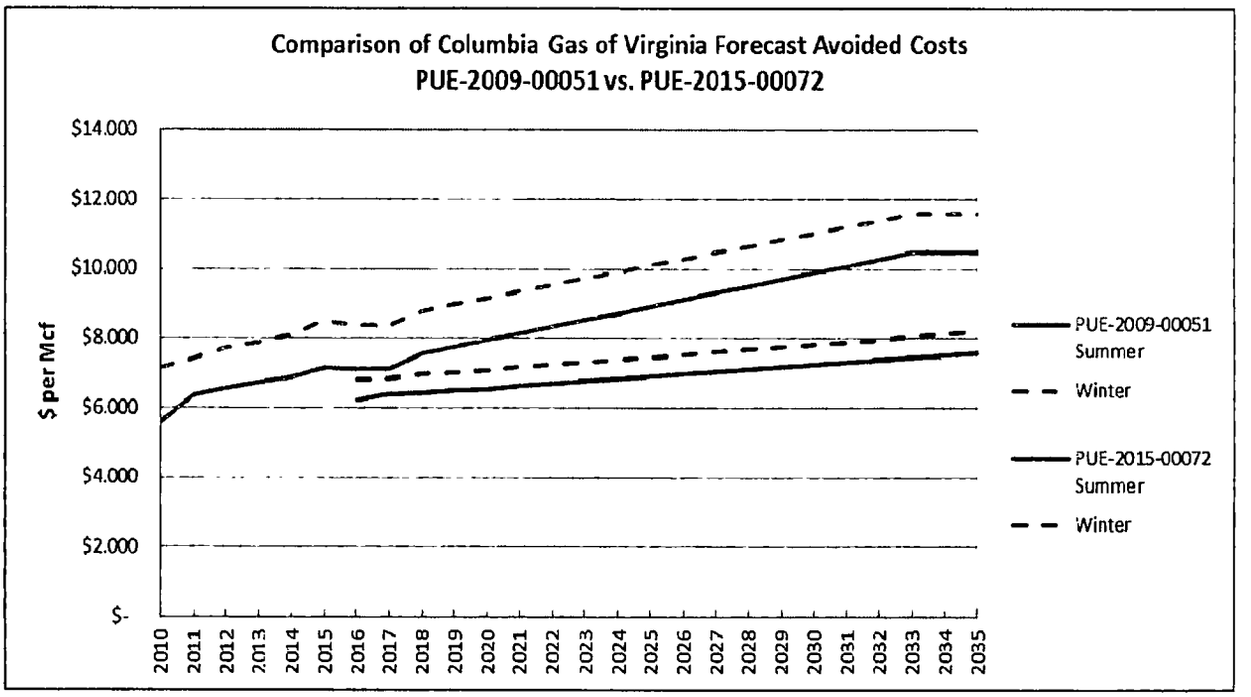
[59] *Application of Columbia Gas of Virginia, Inc., For authorization to amend and extend its conservation and ratemaking efficiency plan pursuant to Virginia Code § 56-602*, Doc. Cen. Con. No. 160240141, Order Approving Amended Natural Gas Conservation and Ratemaking Efficiency Plan (Feb. 23, 2016).

[60] *Application of Washington Gas Light Company, For authority to amend its natural gas conservation and ratemaking efficiency plan*, Case No. PUE-2015-000138, Doc. Cen. Con. No. 160440058, Final Order (April 29, 2016) ("2015 WGL Case").

[61] Staff Report, Part I, PUE-2015-00138 at 18-19.

Finally, Staff notes that over the past approximately eight years, natural gas commodity prices have declined dramatically. The impact of this price decline on the approval of proposed CARE Plan measures and programs cannot be avoided. As a point of reference, Staff presents Chart 1 which illustrates the forecasted avoided cost of natural gas assumed by CGV in the cost/benefit analysis of proposed programs in Case No. PUE-2009-00051 compared to that in Case No. PUE-2015-00072. The chart shows the forecasted summer and winter avoided costs for each CARE Plan proposal.

Chart 1



(ii) Whether Consistent Application of Costs and Benefits Across Utilities Is Necessary or Reasonable;

In general, Staff believes that the consistent application of costs and benefits across utilities is necessary and reasonable. The general principles of cost/benefit analysis are broadly

applicable; for example, all costs associated with a program should be included in the cost/benefit analysis of that program in order to accurately measure a program's cost-effectiveness. The CSPM is also a consistent set of guidelines that can be applied to all utilities.

To the extent that issues may arise that would appear to justify disparate treatment, Staff believes that such issues could be decided by the Commission on a case-by-case basis, but, in general, in the interests of economic efficiency and fairness, the application of costs and benefits should be consistent.

(iii) Whether the Application of the Cost/Benefit Tests Can Be Improved by Enhanced Evaluation and Verification Protocols for Estimating Savings Actually Realized.

Staff believes that the accurate and comprehensive EM&V can improve the application of the cost/benefit tests. EM&V of specific measures or programs should be appropriate to those measures and programs, and the respective EM&V should be credible. Simply establishing a Virginia-specific TRM will not meet this criteria for the reasons discussed above.

The extent and detail of EM&V must be weighed against the costs to conduct a specific EM&V methodology or program; however, if utilities propose measures and programs for which EM&V may be difficult, those utilities should not be averse to devoting the resources EM&V that produces credible estimates of savings. To state this in an alternative manner, if a utility proposes a specific measure or program, that utility should have a plan to credibly and accurately (within reason) measure the effect of that program.

Several entities commented on the balancing of costs with accuracy in EM&V efforts. For example, the Gas Utilities state, "[I]t is not always appropriate, or feasible, to directly measure the impacts, or even directly measure all input variables used[ ] to determine savings

impacts through engineering calculations."[62] However, when engineering calculations are used to measure energy reductions associated with measures such as low-flow showerheads (as discussed above), the use of dated and inappropriate assumptions is inconsistent with the concept of reliable and credible EM&V.

Appropriateness and credibility could be ensured by consideration of EM&V plans at the time that measures and programs are proposed.

Conclusion

The Objectives

The Establishment of Uniform Protocols

Uniform protocols are procedures for reliably and consistently estimating the energy savings and related service-territory impacts resulting from demand-side management programs and measures sponsored by investor-owned utilities and electric cooperatives. There are a number of existing protocols of varying degrees of complexity, as well as several sets of guidelines to aid in the development of uniform protocols.

The Commission could adopt a set of uniform protocols from the extant group of general protocols or it could decide to develop uniform protocols for investor-owned utilities and electric cooperatives to follow when measuring the energy savings and impacts resulting from demand-side management programs. Establishing uniform protocols or a TRM would be an elaborate and detailed process, but with either option, there are a number of considerations with which the Commission will be faced. Among these are whether to institute a separate proceeding with stakeholder involvement, the breadth and level of specificity incorporated into the protocols, and the appropriate balance between the cost of measuring and validating energy

[62] Comments of the Gas Utilities at 24.

savings and impacts and the accuracy of the measurements derived from the protocols and TRMs. The balance between accuracy and the costs of measurement will be a particularly important consideration; however, measurements or estimates derived from protocols or a TRM will involve deemed values to some degree.

The options available to the Commission do not have to be limited simply whether or not to adopt uniform protocols or a TRM. One option could be to adopt general guidelines which could be tailored on a case-by-case basis to suit the specific energy efficiency measure or program under consideration.

Establishment of a Methodology for Estimating Annual Kilowatt Savings

Several responding entities recommend a TRM for estimating annual kW savings; however, a TRM, given the potential for inaccuracy is not likely to be suitable for reliable measurement of kW savings.

A method of estimating annual kW savings is a related component of the EM&V of energy efficiency programs and measures and could, therefore, be developed in the context of EM&V of these programs on a program- or measure-specific basis.

Establishment of a Formula to Calculate the Levelized Cost of Saved Energy

A calculated levelized cost of saved energy can be used to compare costs of an energy efficiency measure or program; however, this has limited usefulness and should not be used as a substitute for more detailed costs and benefits studies.

There are two basic formulas for calculating the levelized cost of energy, the main difference being the omission or inclusion of participant costs. If the Commission finds that a formula for the levelized cost of saved energy should be developed, the Commission will need

to determine the appropriate formulation of the equation and formalize the definitions of the inputs of the formula, such as the appropriate interest rate to employ in the calculation.

The Cost/Benefit Questions

Whether Application of Costs and Benefits is Consistent Across Utilities

The application of costs and benefits is generally consistent across utilities. While Staff believes that the cost/benefit methodologies are applied consistently, inputs for the calculation of the components of the cost/benefit tests are not always calculated consistently among utilities.

While there may be perceived inconsistencies in the application of costs and benefits across utilities, this perception arises largely from changes in energy prices over time, differences in appropriate assumptions for the respective utilities, and differences related to the respective utilities' EM&V.

Whether Consistent Application of Costs and Benefits Across Utilities Is Necessary or Reasonable

The general principles of cost/benefit analysis are broadly applicable, and the California Standard Practice Manual is a consistent guideline. Therefore, in the interest of fairness and economic efficiency, the application of costs and benefits across utilities should be consistent.

To the extent that issues may arise that would appear to justify disparate treatment, Staff believes that the Commission could decide such issues on a case-by-case basis.

Whether the Application of the Cost/Benefit Tests Can Be Improved by Enhanced Evaluation and Verification Protocols for Estimating Savings Actually Realized

Accurate and comprehensive EM&V can improve the application of the cost/benefit tests. EM&V should be credible and appropriate to the measures and programs being evaluated. A given measure or program proposed by an investor-owned utility or electric cooperative should be credibly and accurately (within reason) evaluated. Credible estimates of savings will lead to more credible cost/benefit tests results.

Accuracy of measurement of estimated savings must be balanced against the cost of achieving a given level of accuracy; however, the validity of the cost/benefit test results for a given measure or program is undermined if the estimated savings of that measure or program is not credible.

Selected Evaluation, Measurement & Verification Protocols

Uniform Methods Project (2015); U.S. Department of Energy.

California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals (2006); California Public Utility Commission.

International Performance Measurement and Verification Protocol (2012); Efficiency Valuation Organization.

Federal Energy Management Program M & V Guidelines: Measurement and Verification for Performance-Based Contracts, Version 4.0 (2015); U.S. Department of Energy.

ASHRAE Guideline 14, Measurement of Energy, Demand, and Water Savings (2014); American Society of Heating, Refrigeration, and Air Conditioning Engineers.

Measurement and Verification of Demand Reduction Value from Demand Resources (Manual M-MVDR, 2014); ISO-New England.

Energy Efficiency Measurement & Verification (PJM Manual 18B, 2015); PJM Interconnection.

Measurement & Verification of Energy Efficiency Program (2016); North American Energy Standards Board

Guidance Documents for Evaluation, Measurement & Verification Protocols

Energy Efficiency Program Impact Evaluation Guide (2012); State and Local energy Efficiency Action Network (SEE)

Evaluation Measurement and Verification Guidance for Demand-Side Energy Efficiency -Draft (2015); U.S. Environmental Protection Agency

NEEP Regional-Common EM&V Methods and Savings Assumptions Guidelines (2010); Northeast Energy Efficiency Partnership

<u>Guidance Documents for Evaluation, Measurement & Verification Protocols (cont.)</u>

State Plan Considerations (2014); U.S. Environment Protection Agency.

Measurement & Verification Protocol Selection Guide and Example M & V Plan (2012); Bonneville Power Administration.

LEVELIZED COST OF SAVED ENERGY

EQUATIONS

Equation (1)

LCSE ($/kWh or therm) = (C * Capital Recovery Factor) / D

Where:

C = Total annual program administrator costs;

D = Incremental net annual energy (kWh or therms) saved by energy efficiency programs;

Capital Recovery Factor = (A * (1 + A) ^ B) / (((1 + A) ^ B) – 1)

A = Real discount (interest) rate;

B = Estimated program measure life in years

Equation (2)

LCSE[63] ($/kWh or therm) = (Capital Recovery Factor * (Program Administrator Costs + Participant Costs)) / Net Annual Energy Savings

Where:

Program Administrator Costs = Total program administrator costs;

Participant Costs = Incremental participant costs exclusive of incentives;

Net Annual Energy Savings = Incremental net annual energy (kWh or therms) saved by energy efficiency programs;

Capital Recover Factor = defined as above in Eq. (1)

[63] Staff made one substantive alteration in Eq. (2) by changing the denominator of the equation from Gross Annual Energy Savings to Net Annual Energy Savings. The LBNL authors note that Net Savings could be used, but that sufficient data for the calculation of Net Savings was not available at the time of their study. Staff believes that net energy savings is the appropriate measurement. Staff also has modified slightly the nomenclature of Eq. (2).